WHAT IS CLAIMED IS:

1. A method of *ex-vivo* expanding a population of hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of the hematopoietic stem cells *ex-vivo*, the method comprising providing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells, with *ex-vivo* culture conditions for *ex-vivo* cell proliferation and, at the same time, for reducing an expression and/or activity of CD38, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*.

2. A method of hematopoietic cells transplantation or implantation comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a donor;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing an expression and/or activity of CD38, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) transplanting or implanting said hematopoietic stem cells to a recipient.

3. The method of claim 2, wherein said donor and said recipient are a single individual.

4. A method of genetically modifying hematopoietic stem cells with an exogene comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing an expression and/or activity of CD38, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) genetically modifying said hematopoietic stem cells with the exogene.

5. The method of claim 4, wherein genetically modifying is effected by a vector which comprises the exogene.

6. The method of claim 5, wherein the vector is a viral vector or a nucleic acid vector.

7. A method of adoptive immunotherapy comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a recipient;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing an expression and/or activity of CD38, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells; and

(c) transplanting said hematopoietic stem cells to the recipient.

8. A transplantable hematopoietic cell preparation comprising an expanded population of hematopoietic stem cells propagated *ex-vivo* from hematopoietic mononuclear cells which comprise, prior to expansion, a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells, in the presence of an effective amount of an agent, said agent reducing an expression and/or activity of CD38, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells, and a pharmaceutically acceptable carrier.

9. The method of any of claims 1, 2, 4, and 7, wherein said hematopoietic mononuclear cells are derived from a source selected from the group consisting of bone marrow, peripheral blood and neonatal umbilical cord blood.

10. The method of any of claims 1, 2, 4 and 7, wherein providing said hematopoietic mononuclear cells with said conditions for *ex-vivo* cell proliferation comprises providing said hematopoietic mononuclear cells with nutrients and with cytokines.

11. The method of claim 10, wherein said cytokines are early acting cytokines.

12. The method of claim 11, wherein said early acting cytokines are selected from the group consisting of stem cell factor, FLT3 ligand, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-10, interleukin-12, tumor necrosis factor-a and thrombopoietin.

13. The method of claim 10, wherein said cytokines are late acting cytokines.

14. The method of claim 13, wherein said late acting cytokines are selected from the group consisting of granulocyte colony stimulating factor, granulocyte/macrophage colony stimulating factor, erythropoietin, FGF, EGF, NGF, VEGF, LIF, Hepatocyte growth factor and macrophage colony stimulating factor.

15. The method of any of claims 1, 2, 4 and 7, wherein providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for reducing said expression and/or said activity of CD38 is by providing said hematopoietic mononuclear cells with an agent that downregulates CD38 expression.

16. The transplantable hematopoietic cell preparation of claim 8, wherein said agent is an agent that downregulates CD38 expression.

17. The method of any of claims 15 and 16, wherein said agent that downregulates CD38 expression is selected from the group consisting of a retinoic acid receptor antagonist, a retinoid X receptor antagonist and a Vitamin D receptor antagonist.

18. The method of any of claims 15 and 16, wherein said agent that downregulates CD38 expression is an antagonist for reducing a capacity of said hematopoietic mononuclear cells in responding to retinoic acid, retinoid and/or Vitamin D.

19. The method of any of claims 15 and 16, wherein said agent that downregulates CD38 expression is a polynucleotide.

20. The method of claim 19, wherein said polynucleotide encodes an anti CD38, an anti retinoic acid receptor, an anti retinoid X receptor or an anti Vitamin D receptor intracellular antibody.

21. The method of claim 19, wherein said polynucleotide encodes an anti CD38, an anti retinoic acid receptor, an anti retinoid X receptor or an anti Vitamin D receptor antibody.

22. The method of claim 19, wherein said polynucleotide is a small interfering polynucleotide molecule directed to cause intracellular CD38, retinoic acid receptor, retinoid X receptor or Vitamin D receptor mRNA degradation.

23. The method of claim 22, wherein said small interfering polynucleotide molecule is selected from the group consisting of an RNAi molecule, an anti-sense molecule, a rybozyme molecule and a DNAzyme molecule.

24. The method of any of claims 15 and 16, wherein said agent that downregulates CD38 expression is an agent that downregulates PI 3-kinase expression.

25. The method of claim 24, wherein said agent that downregulates PI 3-kinase expression is a polynucleotide.

26. The method of claim 24, wherein agent that downregulates PI 3-kinase expression is an intracellular antibody.

27. The method of claim 25, wherein said polynucleotide is a small interfering polynucleotide molecule directed to cause intracellular PI 3-kinase mRNA or gene degradation.

28. The method of claim 27, wherein said small interfering polynucleotide molecule is selected from the group consisting of an RNAi molecule, an anti-sense molecule, a rybozyme molecule and a DNAzyme molecule.

29. The method of any of claims 15 and 16, wherein said agent that downregulates CD38 expression is an agent that inhibits PI 3-kinase activity.

30. The method of claim 30, wherein said agent that inhibits PI 3-kinase activity is selected from the group consisting of wortmannin and LY294002

31. The method of any of claims 1, 2, 4 and 7, wherein providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for reducing said expression and/or said activity of CD38 is by providing said hematopoietic mononuclear cells with an agent that inhibits CD38 activity.

32. The transplantable hematopoietic cell preparation of claim 8, wherein said agent is an agent that inhibits CD38 activity.

33. The method of any of claims 31 and 32, wherein said agent that inhibits CD38 activity is nicotinamide, a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide analog metabolite.

34. The method of claim 33, wherein said nicotinamide analog is selected from the group consisting of benzamide, nicotinethioamide, nicotinic acid and α-amino-3-indolepropionic acid.

35. The method of any of claims 1, 2, 4 and 7, wherein providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for reducing said expression and/or said activity of CD38 is by providing said hematopoietic mononuclear cells with an agent that inhibits PI 3-kinase activity.

36. The transplantable hematopoietic cell preparation of claims 8, wherein said agent is an agent that inhibits PI 3-kinase activity.

37. The method of any of claims 35 and 36, wherein said agent that inhibits PI 3-kinase activity is selected from the group consisting of wortmannin and LY294002.

38. A method of *ex-vivo* expanding a population of hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of the hematopoietic stem cells *ex-vivo*, the method comprising providing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells, with *ex-vivo* culture conditions for *ex-vivo* cell proliferation and, at the same time, for reducing a capacity of said hematopoietic mononuclear cells in responding to retinoic acid, retinoids and/or Vitamin D, thereby expanding a population of said hematopoietic stem cells while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*.

39. A method of hematopoietic cells transplantation or implantation comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a donor;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing a capacity of said hematopoietic mononuclear cells in responding to retinoic acid, retinoids and/or Vitamin D, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) transplanting or implanting said hematopoietic stem cells to a recipient.

40. The method of claim 39, wherein said donor and said recipient are a single individual.

41. A method of genetically modifying hematopoietic stem cells with an exogene comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing a capacity of said hematopoietic mononuclear cells in responding to retinoic acid, retinoids and/or Vitamin D, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) genetically modifying said hematopoietic stem cells with the exogene.

42. The method of claim 41, wherein genetically modifying is effected by a vector which comprises the exogene.

43. The method of claim 42, wherein the vector is a viral vector or a nucleic acid vector.

44. A method of adoptive immunotherapy comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a recipient;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing a capacity of said hematopoietic mononuclear cells in responding to retinoic acid, retinoids and/or Vitamin D, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells; and

(c) transplanting said hematopoietic stem cells to the recipient.

45. A transplantable hematopoietic cell preparation comprising an expanded population of hematopoietic stem cells propagated *ex-vivo* from hematopoietic mononuclear cells which comprise, prior to expansion, a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of an effective amount of an agent, said agent reducing a capacity of said hematopoietic mononuclear cells in responding to retinoic acid, retinoids and/or Vitamin D, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells, and a pharmaceutically acceptable carrier.

46. The method and/or the transplantable hematopoietic cell preparation of any of claims 38, 39, 41, 44 and 45, wherein said hematopoietic mononuclear cells are derived from a source selected from the group consisting of bone marrow, peripheral blood and neonatal umbilical cord blood.

47. The method of any of claims 38, 39, and 44, wherein providing said hematopoietic mononuclear cells with said conditions for *ex-vivo* cell proliferation comprises providing said hematopoietic mononuclear cells with nutrients and with cytokines.

48. The method of claim 47, wherein said cytokines are early acting cytokines.

49. The method of claim 48, wherein said early acting cytokines are selected from the group consisting of stem cell factor, FLT3 ligand, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-10, interleukin-12, tumor necrosis factor-a and thrombopoietin.

50. The method of claim 47, wherein said cytokines are late acting cytokines.

51. The method of claim 50, wherein said late acting cytokines are selected from the group consisting of granulocyte colony stimulating factor, granulocyte/macrophage colony stimulating factor, erythropoietin, FGF, EGF, NGF, VEGF, LIF, Hepatocyte growth factor and macrophage colony stimulating factor.

52. The method and/or the transplantable hematopoietic cell preparation of any of claims 38, 39, 41, 44 and 45, wherein reducing said capacity of said hematopoietic mononuclear cells in responding to retinoic acid, retinoids and/or Vitamin D is reversible.

53. The method and/or the transplantable hematopoietic cell preparation of any of claims 38, 39, 41, 44 and 45, wherein reducing said capacity of said hematopoietic mononuclear cells in responding to retinoic acid, retinoids and/or Vitamin D is by *ex-vivo* culturing said hematopoietic mononuclear cells in a presence of an effective amount of at least one retinoic acid receptor antagonist, at least one retinoid X receptor antagonist and/or at least one Vitamin D receptor antagonist.

54. The method of claim 53, wherein reducing said capacity of said hematopoietic mononuclear cells in responding to retinoic acid, retinoids and/or Vitamin D is by *ex-vivo* culturing said hematopoietic mononuclear cells in a presence of an effective amount of at least one retinoic acid receptor antagonist, at least one retinoid X receptor antagonist and/or at least one Vitamin D receptor antagonist, for a time period of 0.1-50 % of an entire *ex-vivo* culturing period of said hematopoietic mononuclear cells.

55. The transplantable hematopoietic cell preparation of claim 45, wherein said agent is selected from the group consisting of retinoic acid receptor antagonist, retinoid X receptor antagonist and/or Vitamin D receptor antagonist.

56. The method and/or the transplantable hematopoietic cell preparation of any of claims 53, 54 and 55, wherein said retinoic acid receptor antagonist is selected from the group consisting of:

AGN 194310; AGN 193109; 3–(4-Methoxy-phenylsulfanyl)-3-methyl-butyric acid; 6-Methoxy-2,2-dimethvl-thiochroman-4-one,2,2-Dimethyl-4-oxo-thiochroman-6-yltrifluoromethane-sulfonate; Ethyl 4-((2,2 dimethyl-4-oxo-thiochroman-6-yl)ethynyl)-benzoate; Ethyl 4-((2,2-dimethy 1-4-triflouromethanensulfonyloxy -(2H)-thiochromen-6-yl)ethynyl)-benzoate(41); Thiochromen-6-yl]-ethynyl]-benzoate(yl); (p-[(E)-2-[3'4'-Dihydro-4,4'-dimethyl-7'-(heptyloxy)-2'H-1-benzothiopyran-6'yl] propenyl] benzoic acid 1'1'-dioxide; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-butoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-propoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-pentoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-hexoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-heptoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-octoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; (2E,4E,6E)-7-[3-t-butyl-5-(1-phenyl-vinyl)-phenyl]-3-methyl-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-{[4,5-.sup.3 H.sub.2]-n-pentoxy}phenyl)-3-methyl]-octa-2,4,6-trienoic acid; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-ethoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid ethyl ester; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-ethoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-butoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-ethoxyphenyl]3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-butyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; 4-(5,6,7,8-tetrahydro-5,5,8,8-tetramethyl-2-naphthalene-carboxamido) benzoic acid; (2E,4E)-3-methyl-5-[(1S,2S)-2-(5,5,8,8-tetramethyl-5,6,7,8-tetrahydro-naphthalen-2-yl)-cyclopropyl]-penta-2,4-dienoic acid; p-[(E)-2-[3',4'-Dihydro-4',4'-dimethyl-7'-(heptyloxy)-2'H-1-benzothiopyran-6'-yl]propenyl]benzoic acid; 1',1'-dioxide, 4-(7,7,10,10-Tetramethyl-1-pyridin-3-ylmethyl-4,5,7,8,9,10-hexahydro-1H-naphto[2,3-

g]indol-3-yl)-benzoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-methoxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-ethoxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-hexyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-octyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; and (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert-butyl-2-butoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid, (2E,4E,6Z)-7-(3-n-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)-3-methylocta-2,4,6-trienoic acid, 4-(5H-2,3(2,5 dimethyl-2,5-hexano)-5-n-propyldibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, 4-(5H-2,3-(2,5-dimethyl-2,5-hexano)-5methyl-8-nitrodibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, 4-{[4-(4-Ethylphenyl)2,2-dimethyl-(2H)-thiochromen-6-yl]ethynyl}benzoic acid, 4-[4-2methyl-1,2-dicarba-closo-dodecaboran-1-yl-phenylcarbamoyl]benzoic acid, 4-[4,5,7,8,9,10-hexahydro-7,7,10,10-tetramethyl-1-(3-pyridylmethyl)-anthra[1,2-b]pyrrol-3-yl]benzoic acid, (3-pyridylmethyl)-]5-thiaanthra[2,1-b]pyrrol-3-yl)benzoic acid, and (3-pyridylmethyl)-anthra[2m1-d]pyrazol-3-yl]benzoic acid.

57. The method and/or the transplantable hematopoietic cell preparation of any of claims 53, 54 and 55, wherein said retinoid X receptor antagonist is selected from the group consisting of:

LGN100572, LGN100574, 1-(3-hydroxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)ethanone, 1-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)ethanone, 3-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)but-2-enenitrile, 3-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)but-2-enal, (2E,4E,6E)-7-3[-propoxy-5,6,7,8-tetrahydro 5,5,8,8-tetramethyl-2-naphthalene-2-yl]-3-methylocta-2,4,6-trienoic acid, 4-[3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl] benzoic acid, 4-[1-(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl] benzoic acid, 4-[1(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)cyclopropyl] benzoic acid, 4-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl] benzenete trazole, 2-[1-(5,5,8,8-tetramethyl-5,6,7,8-tetrahydro-2-naphthyl) ethenyl]pyridine-5-carboxylic acid, 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethyl]pyridine-5-carboxylic acid, ethyl-2-[1-(3,5,5,8, 8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]pyridine-5-carboxylate, 5-[1-3,5,5,8,8-pentamethyl-

5,6,7,8-tetrahydro-2-naphthyl)ethenyl]pyridine-2-carboxylic acid, 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) cyclopropyl]pyridine-5-carboxylic acid, methyl 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)cyclopropyl]pyridine-5-carboxylate, 4-[1-(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]-N-(4-hydroxyphenyl) benzamide, 2-[1-(3,5,5,8,8-Pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) ethenyl] pyridine-5-carboxylic acid, 2-[1-(3,5,5,8,8-Pentamethyl-5, 6,7,8-tetrahydro-2-naphthyl)cyclopropyl]pyridine-5-carboxylic acid, 4-[(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid butyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) carbonyl]benzoic acid propyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-terrahydro-2-naphthyl)carbonyl]benzoic acid cyanoimine, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid allyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid 4-(3-methylbut-2-enoic acid)oxime, and 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid 1-aminoethyloxime, (2E,4E,6Z)-7-(3-n-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)-3-methylocta-2,4,6-trienoic acid, 4-(5H-2,3(2,5 dimethyl-2,5-hexano)-5-n-propyldibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, and 4-(5H-2,3-(2,5-dimethyl-2,5-hexano)-5methyl-8-nitrodibenzo[b,e][1,4]diazepin-11-yl)benzoic acid.

58. The method and/or the transplantable hematopoietic cell preparation of any of claims 53, 54 and 55, wherein said Vitamin D receptor antagonist is selected from the group consisting of: 1 alpha, 25-(OH)-D3-26,23 lactone; 1alpha, 25-dihydroxyvitamin D (3); the 25-carboxylic ester ZK159222; (23S)- 25-dehydro-1 alpha-OH-D (3); (23R)-25-dehydro-1 alpha-OH-D (3); 1 beta, 25 $(OH)_2$ D_3; 1 beta, 25$(OH)_2$-3-epi-D_3; (23S) 25-dehydro-1 alpha(OH) D3-26,23-lactone; (23R) 25-dehydro-1 alpha(OH)D3-26,23-lactone and Butyl-(5Z,7E,22E-(1S,7E,22E-(1S,3R,24R)-1,3,24-trihydroxy-26,27-cyclo-9,10-secocholesta-5,7,10(19),22-tetraene-25-carboxylate).

59. A method of *ex-vivo* expanding a population of hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of the hematopoietic stem cells *ex-vivo*, the method comprising providing hematopoietic

mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells, with *ex-vivo* culture conditions for *ex-vivo* cell proliferation and, at the same time, for reducing a capacity of said hematopoietic mononuclear cells in responding to signaling pathways involving the retinoic acid receptor, the retinoid X receptor and/or the Vitamin D receptor, thereby expanding a population of said hematopoietic stem cells while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*.

60. A method of hematopoietic cells transplantation or implantation comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a donor;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing a capacity of said hematopoietic mononuclear cells in responding to signaling pathways involving the retinoic acid receptor, the retinoid X receptor and/or the Vitamin D receptor, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) transplanting or implanting said hematopoietic stem cells to a recipient.

61. The method of claim 60, wherein said donor and said recipient are a single individual.

62. A method of genetically modifying hematopoietic stem cells with an exogene comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing a capacity of said

hematopoietic mononuclear cells in responding to signaling pathways involving the retinoic acid receptor, the retinoid X receptor and/or the Vitamin D receptor, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) genetically modifying said hematopoietic stem cells with the exogene.

63. The method of claim 62, wherein genetically modifying is effected by a vector which comprises the exogene.

64. The method of claim 63, wherein the vector is a viral vector or a nucleic acid vector.

65. A method of adoptive immunotherapy comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a recipient;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing a capacity of said hematopoietic mononuclear cells in responding to signaling pathways involving the retinoic acid receptor, the retinoid X receptor and/or the Vitamin D receptor, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells; and

(c) transplanting said hematopoietic stem cells to the recipient.

66. A transplantable hematopoietic cell preparation comprising an expanded population of hematopoietic stem cells propagated *ex-vivo* from hematopoietic mononuclear cells which comprise, prior to expansion, a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of an effective amount of an agent, said agent reducing a capacity of said hematopoietic mononuclear cells in responding to signaling pathways involving the retinoic acid receptor, the retinoid X receptor and/or the Vitamin D receptor, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells, and a pharmaceutically acceptable carrier.

67. The method and/or the transplantable hematopoietic cell preparation of any of claims 59, 60, 62, 65 and 66, wherein said hematopoietic mononuclear cells are derived from a source selected from the group consisting of bone marrow, peripheral blood and neonatal umbilical cord blood.

68. The method of any of claims 59, 60, and 65, wherein providing said hematopoietic mononuclear cells with said conditions for *ex-vivo* cell proliferation comprises providing said hematopoietic mononuclear cells with nutrients and with cytokines.

69. The method of claim 68, wherein said cytokines are early acting cytokines.

70. The method of claim 69, wherein said early acting cytokines are selected from the group consisting of stem cell factor, FLT3 ligand, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-10, interleukin-12, tumor necrosis factor-a and thrombopoietin.

71. The method of claim 68, wherein said cytokines are late acting cytokines.

72. The method of claim 71, wherein said late acting cytokines are selected from the group consisting of granulocyte colony stimulating factor, granulocyte/macrophage colony stimulating factor, erythropoietin, FGF, EGF, NGF, VEGF, LIF, Hepatocyte growth factor and macrophage colony stimulating factor.

73. The method and/or the transplantable hematopoietic cell preparation of any of claims 59, 60, 62, 65 and 66, wherein reducing said capacity of said hematopoietic mononuclear cells in responding to signaling pathways involving the retinoic acid receptor, the retinoid X receptor and/or the Vitamin D receptor is reversible.

74. The method and/or the transplantable hematopoietic cell preparation of any of claims 59, 60, 62, 65 and 66, wherein reducing said capacity of said hematopoietic mononuclear cells in responding to signaling pathways involving the retinoic acid receptor, the retinoid X receptor and/or the Vitamin D receptor is by *ex-vivo* culturing said hematopoietic mononuclear cells fraction in a presence of an effective amount of at least one retinoic acid receptor antagonist, at least one retinoid X receptor antagonist and/or at least one Vitamin D receptor antagonist.

75. The method of claim 74, wherein reducing said capacity of said hematopoietic mononuclear cells in responding to signaling pathways involving the retinoic acid receptor, the retinoid X receptor and/or the Vitamin D receptor is by *ex-vivo* culturing said hematopoietic mononuclear cells in a presence of an effective amount of at least one retinoic acid receptor antagonist, at least one retinoid X receptor antagonist and/or at least one Vitamin D receptor antagonist, for a time period of 0.1-50 % of an entire *ex-vivo* culturing period of said hematopoietic mononuclear cells.

76. The transplantable hematopoietic cell preparation of claim 66, wherein said agent is selected from the group consisting of retinoic acid receptor antagonist, retinoid X receptor antagonist and/or Vitamin D receptor antagonist.

77. The method and/or the transplantable hematopoietic cell preparation of any of claims 74, 75 and 76, wherein said retinoic acid receptor antagonist is selected from the group consisting of:
AGN 194310; AGN 193109; 3–(4-Methoxy-phenylsulfanyl)-3-methyl-butyric acid; 6-Methoxy-2,2-dimethvl-thiochroman-4-one,2,2-Dimethyl-4-oxo-thiochroman-6-yltrifluoromethane-sulfonate; Ethyl 4-((2,2 dimethyl-4-oxo-thiochroman-6-yl)ethynyl)-benzoate; Ethyl 4-((2,2-dimethy 1-4-triflouromethanensulfonyloxy -(2H)-thiochromen-6-yl)ethynyl)-benzoate(41); Thiochromen-6-yl]-ethynyl]-benzoate(yl); (p-[(E)-2-[3'4'-Dihydro-4,4'-dimethyl-7'-(heptyloxy)-2'H-1-benzothiopyran-6'yl] propenyl] benzoic acid 1'1'-dioxide; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-butoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-propoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-pentoxyphenyl)-

3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-hexoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-heptoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-octoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; (2E,4E,6E)-7-[3-t-butyl-5-(1-phenyl-vinyl)-phenyl]-3-methyl-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-{[4,5-.sup.3 H.sub.2]-n-pentoxy}phenyl)-3-methyl]-octa-2,4,6-trienoic acid; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-ethoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid ethyl ester; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-ethoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-butoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-ethoxyphenyl]3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-butyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; 4-(5,6,7,8-tetrahydro-5,5,8,8-tetramethyl-2-naphthalene-carboxamido) benzoic acid; (2E,4E)-3-methyl-5-[(1S,2S)-2-(5,5,8,8-tetramethyl-5,6,7,8-tetrahydro-naphthalen-2-yl)-cyclopropyl]-penta-2,4-dienoic acid; p-[(E)-2-[3',4'-Dihydro-4',4'-dimethyl-7'-(heptyloxy)-2'H-1-benzothiopyran-6'-yl]propenyl]benzoic acid; 1',1'-dioxide, 4-(7,7,10,10-Tetramethyl-1-pyridin-3-ylmethyl-4,5,7,8,9,10-hexahydro-1H-naphto[2,3-g]indol-3-yl)-benzoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-methoxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-ethoxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-hexyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-octyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; and (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert-butyl-2-butoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid, (2E,4E,6Z)-7-(3-n-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)-3-methylocta-2,4,6-trienoic acid, 4-(5H-2,3(2,5 dimethyl-2,5-hexano)-5-n-propyldibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, 4-(5H-2,3-(2,5-dimethyl-2,5-hexano)-5methyl-8-nitrodibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, 4-{[4-(4-Ethylphenyl)2,2-dimethyl-(2H)-thiochromen-6-yl]ethynyl}benzoic acid, 4-[4-2methyl-1,2-dicarba-closo-dodecaboran-1-yl-phenylcarbamoyl]benzoic acid, 4-[4,5,7,8,9,10-hexahydro-7,7,10,10-tetramethyl-1-(3-pyridylmethyl)-anthra[1,2-b]pyrrol-3-yl]benzoic acid, (3-pyridylmethyl)-]5-thiaanthra[2,1-b]pyrrol-3-yl)benzoic acid, and (3-pyridylmethyl)-anthra[2m1-d]pyrazol-3-yl]benzoic acid.

78. The method and/or the transplantable hematopoietic cell preparation of any of claims 74, 75 and 76, wherein said retinoid X receptor antagonist is selected from the group consisting of:

LGN100572, LGN100574, 1-(3-hydroxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)ethanone, 1-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)ethanone, 3-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)but-2-enenitrile, 3-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)but-2-enal, (2E,4E,6E)-7-3[-propoxy-5,6,7,8-tetrahydro 5,5,8,8-tetramethyl-2-naphthalene-2-yl]-3-methylocta-2,4,6-trienoic acid, 4-[3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl] benzoic acid, 4-[1-(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl] benzoic acid, 4-[1(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)cyclopropyl] benzoic acid, 4-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl] benzenete trazole, 2-[1-(5,5,8,8-tetramethyl-5,6,7,8-tetrahydro-2-naphthyl) ethenyl]pyridine-5-carboxylic acid, 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethyl]pyridine-5-carboxylic acid, ethyl-2-[1-(3,5,5,8, 8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]pyridine-5-carboxylate, 5-[1-3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]pyridine-2-carboxylic acid, 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) cyclopropyl]pyridine-5-carboxylic acid, methyl 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)cyclopropyl]pyridine-5-carboxylate, 4-[1-(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]-N-(4-hydroxyphenyl) benzamide, 2-[1-(3,5,5,8,8-Pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) ethenyl] pyridine-5-carboxylic acid, 2-[1-(3,5,5,8,8-Pentamethyl-5, 6,7,8-tetrahydro-2-naphthyl)cyclopropyl]pyridine-5-carboxylic acid, 4-[(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid butyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) carbonyl]benzoic acid propyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-terrahydro-2-naphthyl)carbonyl]benzoic acid cyanoimine, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid allyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid 4-(3-methylbut-2-enoic acid)oxime, and 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid 1-aminoethyloxime, (2E,4E,6Z)-7-(3-n-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)-3-methylocta-2,4,6-

trienoic acid, 4-(5H-2,3(2,5 dimethyl-2,5-hexano)-5-n-propyldibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, and 4-(5H-2,3-(2,5-dimethyl-2,5-hexano)-5methyl-8-nitrodibenzo[b,e][1,4]diazepin-11-yl)benzoic acid.

79. The method and/or the transplantable hematopoietic cell preparation of any of claims 74, 75 and 76, wherein said Vitamin D receptor antagonist is selected from the group consisting of: 1 alpha, 25-(OH)-D3-26,23 lactone; 1alpha, 25-dihydroxyvitamin D (3); the 25-carboxylic ester ZK159222; (23S)- 25-dehydro-1 alpha-OH-D (3); (23R)-25-dehydro-1 alpha-OH-D (3); 1 beta, 25 $(OH)_2$ D_3; 1 beta, 25$(OH)_2$-3-epi-D_3; (23S) 25-dehydro-1 alpha(OH) D3-26,23-lactone; (23R) 25-dehydro-1 alpha(OH)D3-26,23-lactone and Butyl-(5Z,7E,22E-(1S,7E,22E-(1S,3R,24R)-1,3,24-trihydroxy-26,27-cyclo-9,10-secocholesta-5,7,10(19),22-tetraene-25-carboxylate).

80. A method of *ex-vivo* expanding a population of hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of the hematopoietic stem cells *ex-vivo*, the method comprising providing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells, with *ex-vivo* culture conditions for *ex-vivo* cell proliferation and with nicotinamide, a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide analog metabolite thereby expanding a population of said hematopoietic stem cells while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*.

81. A method of hematopoietic cells transplantation or implantation comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a donor;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and with nicotinamide, a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide

analog metabolite, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) transplanting or implanting said hematopoietic stem cells to a recipient.

82. The method of claim 81, wherein said donor and said recipient are a single individual.

83. A method of genetically modifying hematopoietic stem cells with an exogene comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and with nicotinamide, a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide analog metabolite, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) genetically modifying said hematopoietic stem cells with the exogene.

84. The method of claim 83, wherein genetically modifying is effected by a vector which comprises the exogene.

85. The method of claim 84, wherein the vector is a viral vector or a nucleic acid vector.

86. A method of adoptive immunotherapy comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a recipient;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and with nicotinamide, a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide analog metabolite, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells; and

(c) transplanting said hematopoietic stem cells to the recipient.

87. A transplantable hematopoietic cell preparation comprising an expanded population of hematopoietic stem cells propagated *ex-vivo* from hematopoietic mononuclear cells which comprise, prior to expansion, a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of an effective amount of an agent selected from the group consisting of nicotinamide, a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide analog metabolite, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells, and a pharmaceutically acceptable carrier.

88. The method and/or the transplantable hematopoietic cell preparation of any of claims 80, 81, 83, 86 and 87, wherein said hematopoietic mononuclear cells are derived from a source selected from the group consisting of bone marrow, peripheral blood and neonatal umbilical cord blood.

89. The method of any of claims 80, 81, and 86, wherein providing said hematopoietic mononuclear cells with said conditions for *ex-vivo* cell proliferation comprises providing said hematopoietic mononuclear cells with nutrients and with cytokines.

90. The method of claim 89, wherein said cytokines are early acting cytokines.

91. The method of claim 90, wherein said early acting cytokines are selected from the group consisting of stem cell factor, FLT3 ligand, interleukin-1,

interleukin-2, interleukin-3, interleukin-6, interleukin-10, interleukin-12, tumor necrosis factor-a and thrombopoietin.

92. The method of claim 89, wherein said cytokines are late acting cytokines.

93. The method of claim 92, wherein said late acting cytokines are selected from the group consisting of granulocyte colony stimulating factor, granulocyte/macrophage colony stimulating factor, erythropoietin, FGF, EGF, NGF, VEGF, LIF, Hepatocyte growth factor and macrophage colony stimulating factor.

94. The method and/or the transplantable hematopoietic cell preparation of any of claims 80, 81, 83, 86 and 87, wherein said nicotinamide analog is selected from the group consisting of benzamide, nicotinethioamide, nicotinic acid and α-amino-3-indolepropionic acid.

95. A method of *ex-vivo* expanding a population of hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of the hematopoietic stem cells *ex-vivo*, the method comprising providing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells, with *ex-vivo* culture conditions for *ex-vivo* cell proliferation and, at the same time, for reducing an expression and/or activity of PI 3-kinase, thereby expanding a population of said hematopoietic stem cells while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*.

96. A method of hematopoietic cells transplantation or implantation comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a donor;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing an expression and/or activity of PI 3-kinase, thereby expanding a population of said hematopoietic

stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) transplanting or implanting said hematopoietic stem cells to a recipient.

97. The method of claim 96, wherein said donor and said recipient are a single individual.

98. A method of genetically modifying hematopoietic stem cells with an exogene comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing an expression and/or activity of PI 3-kinase, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) genetically modifying said hematopoietic stem cells with the exogene.

99. The method of claim 98, wherein genetically modifying is effected by a vector which comprises the exogene.

100. The method of claim 99, wherein the vector is a viral vector or a nucleic acid vector.

101. A method of adoptive immunotherapy comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a recipient;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, for reducing an expression and/or activity of PI 3-kinase, thereby expanding a population of said hematopoietic

stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells; and

(c) transplanting said hematopoietic stem cells to the recipient.

102. A transplantable hematopoietic cell preparation comprising an expanded population of hematopoietic stem cells propagated *ex-vivo* from hematopoietic mononuclear cells which comprise, prior to expansion, a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of an effective amount of an agent, said agent reducing an expression and/or activity of PI 3-kinase, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells, and a pharmaceutically acceptable carrier.

103. The method of any of claims 95, 96, 98, and 101, wherein said hematopoietic mononuclear cells are derived from a source selected from the group consisting of bone marrow, peripheral blood and neonatal umbilical cord blood.

104. The method of any of claims 95, 96, 98 and 101, wherein providing said hematopoietic mononuclear cells with said conditions for *ex-vivo* cell proliferation comprises providing said hematopoietic mononuclear cells with nutrients and with cytokines.

105. The method of claim 104, wherein said cytokines are early acting cytokines.

106. The method of claim 105, wherein said early acting cytokines are selected from the group consisting of stem cell factor, FLT3 ligand, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-10, interleukin-12, tumor necrosis factor-a and thrombopoietin.

107. The method of claim 104, wherein said cytokines are late acting cytokines.

108. The method of claim 107, wherein said late acting cytokines are selected from the group consisting of granulocyte colony stimulating factor, granulocyte/macrophage colony stimulating factor, erythropoietin, FGF, EGF, NGF, VEGF, LIF, Hepatocyte growth factor and macrophage colony stimulating factor.

109. The method of any of claims 95, 96, 98 and 101, wherein providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for reducing said expression and/or said activity of PI 3-kinase is by providing said hematopoietic mononuclear cells with an agent that downregulates PI 3-kinase expression.

110. The transplantable hematopoietic cell preparation of claim 102, wherein said agent is an agent that downregulates PI 3-kinase expression.

111. The method and/or transplantable hematopoietic cell preparation of any claim 109 and 110, wherein said agent that downregulates PI 3-kinase expression is a polynucleotide.

112. The method and/or transplantable hematopoietic cell preparation of any claim 109 and 110, wherein said agent that downregulates PI 3-kinase expression is an intracellular antibody.

113. The method of claim 112, wherein said polynucleotide is a small interfering polynucleotide molecule directed to cause intracellular PI 3-kinase mRNA or gene degradation.

114. The method of claim 113, wherein said small interfering polynucleotide molecule is selected from the group consisting of an RNAi molecule, an anti-sense molecule, a rybozyme molecule and a DNAzyme molecule.

115. The method and/or transplantable hematopoietic cell preparation of any claim 109 and 110, wherein providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for reducing said expression and/or said activity of PI 3-kinase is by providing said hematopoietic mononuclear cells with an agent that inhibits PI 3-kinase activity.

116. The transplantable hematopoietic cell preparation of claim 102, wherein said agent is an agent that inhibits PI 3-kinase activity.

117. The method and/or the transplantable hematopoietic cell preparation of any of claims 115 and 116, wherein said agent that inhibits PI 3-kinase activity is selected from the group consisting of wortmannin and LY294002

118. A method of *ex-vivo* expanding a population of hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of the hematopoietic stem cells *ex-vivo*, the method comprising providing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells, with *ex-vivo* culture conditions for *ex-vivo* cell proliferation and, at the same time, with at least one copper chelator or chelate, thereby expanding a population of said hematopoietic stem cells while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*.

119. A method of hematopoietic cells transplantation or implantation comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a donor;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, with at least one copper chelator or chelate, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) transplanting or implanting said hematopoietic stem cells to a recipient.

120. The method of claim 119, wherein said donor and said recipient are a single individual.

121. A method of genetically modifying hematopoietic stem cells with an exogene comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, with at least one copper chelator or chelate, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells *ex-vivo*; and

(c) genetically modifying said hematopoietic stem cells with the exogene.

122. The method of claim 121, wherein genetically modifying is effected by a vector which comprises the exogene.

123. The method of claim 122, wherein the vector is a viral vector or a nucleic acid vector.

124. A method of adoptive immunotherapy comprising:

(a) obtaining hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells from a recipient;

(b) providing said hematopoietic mononuclear cells with *ex-vivo* culture conditions for cell proliferation and, at the same time, with at least one copper chelator or chelate, thereby expanding a population of said hematopoietic stem cells, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells; and

(c) transplanting said hematopoietic stem cells to the recipient.

125. A transplantable hematopoietic cell preparation comprising an expanded population of hematopoietic stem cells propagated *ex-vivo* from hematopoietic mononuclear cells which comprise, prior to expansion, a major fraction

of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of an effective amount of at least one copper chelate or chelator, while at the same time, substantially inhibiting differentiation of said hematopoietic stem cells, and a pharmaceutically acceptable carrier.

126. The method and/or the transplantable hematopoietic cell preparation of any of claims 118, 119, 121, 124 and 125, wherein said hematopoietic mononuclear cells are derived from a source selected from the group consisting of bone marrow, peripheral blood and neonatal umbilical cord blood.

127. The method of any of claims 118, 119, and 124, wherein providing said hematopoietic mononuclear cells with said conditions for *ex-vivo* cell proliferation comprises providing said hematopoietic mononuclear cells with nutrients and with cytokines.

128. The method of claim 127, wherein said cytokines are early acting cytokines.

129. The method of claim 128, wherein said early acting cytokines are selected from the group consisting of stem cell factor, FLT3 ligand, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-10, interleukin-12, tumor necrosis factor-a and thrombopoietin.

130. The method of claim 127, wherein said cytokines are late acting cytokines.

131. The method of claim 130, wherein said late acting cytokines are selected from the group consisting of granulocyte colony stimulating factor, granulocyte/macrophage colony stimulating factor, erythropoietin, FGF, EGF, NGF, VEGF, LIF, Hepatocyte growth factor and macrophage colony stimulating factor.

132. The method of any of claims 118, 119, 121 and 124, wherein providing said hematopoietic mononuclear cells with at least one copper chelator or chelate is by providing said hematopoietic mononuclear cells at least one copper chelator.

133. The method of claim 132, further comprising providing said hematopoietic mononuclear cells fraction zinc.

134. The transplantable hematopoietic cell preparation of claim 125, wherein said expanded population of said hematopoietic stem cells fraction is propagated *ex-vivo* from hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of an effective amount of at least one copper chelator.

135. The transplantable hematopoietic cell preparation of claim 134, wherein said expanded population of said hematopoietic stem cells fraction is propagated *ex-vivo* from hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of an effective amount of zinc.

136. An assay of determining whether a transition metal chelate or chelator causes substantial inhibition or induction of differentiation of hematopoietic stem cells, the assay comprising:

culturing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells, in the presence of the transition metal chelate or chelator and monitoring differentiation of said hematopoietic stem cells, wherein if differentiation is increased as is compared to non-treated hematopoietic mononuclear cells, said transition metal chelate induces differentiation, whereas if differentiation is decreased as is compared to non-treated hematopoietic mononuclear cells, or if differentiation is absent altogether, said transition metal chelate inhibits differentiation.

137. The method, the assay and/or the transplantable hematopoietic cell preparation of any of claims 118, 119, 121, 124, 125, 136, and 138-141, wherein said at least one copper chelate or chelator comprises a polyamine chelator.

138. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 137, wherein said polyamine chelator is capable of forming an organometallic complex with a transition metal other than copper.

139. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 138, wherein said transition metal is selected from the group consisting of zinc, cobalt, nickel, iron, palladium, platinum, rhodium and ruthenium.

140. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 137, wherein said polyamine chelator is a linear polyamine.

141. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 140, wherein said linear polyamine has a general formula I:

$$\mathbf{HX\text{-}Am\text{-}(Y_1B_1)_1\cdots(YnBn)n\text{-}ZH}$$

Formula I

wherein:

m is an integer from 1 to 10;

n is an integer from 0 to 20;

X and Z are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

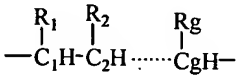
Y_1 and Yn are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

A is an alkylene chain having between 1 and 10 substituted and/or non-substituted carbon atoms; and

B_1 and Bn are each independently an alkylene chain having between 1 and 20 substituted and/or non-substituted carbon atoms,

provided that at least one of said X, Z, Y_1 and Yn is a -NH group and/or at least one of said carbon atoms in said alkylene chains is substituted by an amine group.

142. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 141, wherein said A is an alkylene chain having a general formula II:



Formula II

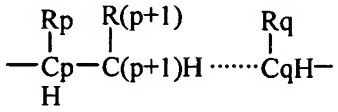
wherein:

g is an integer that equals 0 or 3-10;

each of R_1, R_2 and Rg is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate,

thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

143. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 142, wherein each of B_1 and Bn is independently an alkylene chain having a general formula III:



Formula III

wherein:

p is an integer that equals 0 or g+1;

q is an integer from g+2 to g+20; and

each of Rp, Rp+1 and Rq is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite,

bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

144. The method, the assay, the pharmaceutical composition, the kit, the expanded population and/or the assay of claim 141, wherein said linear polyamine is tetraethylenepentamine.

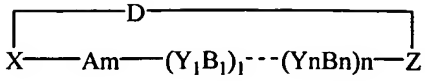
145. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 142, wherein at least one of said C_1, C_2 and Cg is a chiral carbon atom.

146. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 143, wherein at least one of said Cp, Cp+1 and Cq is a chiral carbon atom.

147. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 137, wherein said polyamine chelator is a cyclic polyamine.

148. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 147, wherein said cyclic polyamine is cyclam.

149. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 147, wherein said cyclic polyamine has a general formula IV:



Formula IV

wherein:

m is an integer from 1 to 10;

n is an integer from 0 to 20;

X and Z are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

Y_1 and Yn are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

A is an alkylene chain having between 1 and 10 substituted and/or non-substituted carbon atoms;

B_1 and Bn are each independently an alkylene chain having between 1 and 20 substituted and/or non-substituted carbon atoms; and

D is a bridging group having a general formula V:

U-W-V

Formula V

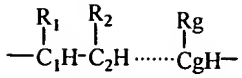
whereas:

U and V are each independently selected from the group consisting of substituted hydrocarbon chain and non-substituted hydrocarbon chain; and

W is selected from the group consisting of amide, ether, ester, disulfide, thioether, thioester, imine and alkene,

provided that at least one of said X, Z, Y_1 and Yn is a -NH group and/or at least one of said carbon atoms in said alkylene chains is substituted by an amine group.

150. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 149, wherein said A is an alkylene chain having a general formula II:



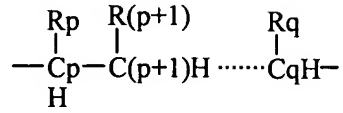
Formula II

wherein:

g is an integer that equals 0 or 3-10; and

each of R_1, R_2 and Rg is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

151. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 150, wherein each of B_1 and Bn is independently an alkylene chain having a general formula III:



Formula III

wherein:

p is an integer that equals 0 or g+1;

q is an integer from g+2 to g+20; and

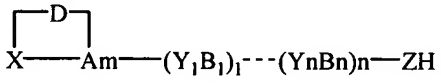
each of Rp, Rp+1 and Rq is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate,

bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

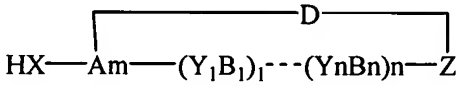
152. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 150, wherein at least one of said C_1, C_2 and Cg is a chiral carbon atom.

153. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 151, wherein at least one of said Cp, Cp+1 and Cq is a chiral carbon atom.

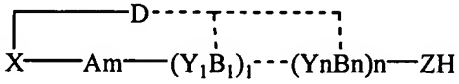
154. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 147, wherein said cyclic polyamine has a general formula selected from the group consisting of:



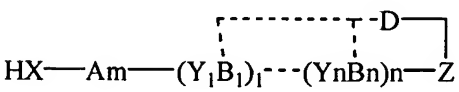
Formula VI



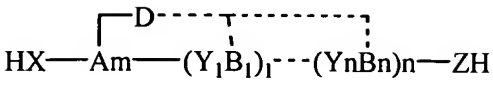
Formula VII



Formula VIII



Formula IX



Formula X

wherein:

m is an integer from 1 to 10;

n is an integer from 0 to 20;

X and Z are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

Y_1 and Yn are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

A is an alkylene chain having between 1 and 10 substituted and/or non-substituted carbon atoms;

B1 and Bn are each independently an alkylene chain having between 1 and 20 substituted and/or non-substituted carbon atoms; and

D is a bridging group having a general formula V:

U-W-V

Formula V

whereas:

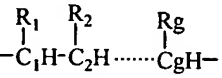
U and V are each independently selected from the group consisting of substituted hydrocarbon chain and non-substituted hydrocarbon chain; and

W is selected from the group consisting of amide, ether, ester, disulfide, thioether, thioester, imine and alkene,

and further wherein should said D is attached at one end to A (Formulas VI, VII and X), said U or said V are being attached to one carbon atom in said alkylene chain and should said D is attached at one end to B1 or Bn (Formulas VIII, IX and X), said U or said V are being attached to one carbon atom in said alkylene chain,

provided that at least one of said X, Z, Y_1 and Yn is a -NH group and/or at least one of said carbon atoms in said alkylene chains is substituted by an amine group.

155. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 154, wherein said A is an alkylene chain having a general formula II:



Formula II

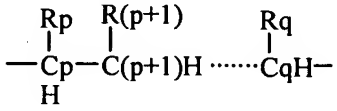
wherein:

g is an integer that equals 0 or 3-10; and

each of R_1, R_2 and Rg is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate,

dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

156. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 155, wherein each of B_1 and Bn is independently an alkylene chain having a general formula III:



Formula III

wherein:

p is an integer that equals 0 or g+1;

q is an integer from g+2 to g+20; and

each of Rp, Rp+1 and Rq is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine

oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

157. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 155, wherein at least one of said C_1, C_2 and Cg is a chiral carbon atom.

158. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 156, wherein at least one of said Cp, Cp+1 and Cq is a chiral carbon atom.

159. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 137, wherein said polyamine chelator includes at least one linear polyamine and at least one cyclic polyamine.

160. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 159, wherein said polyamine chelator has a general formula XI:

$$\{(E_1)_f\text{-}[Q_1\text{-}(G_1)_g]\}_h\text{—}\{(E_2)_i\text{-}[Q_2\text{-}(G_2)_j]\}_k\text{-}\cdots\cdots\text{-}\{(E_n)_l\text{-}[Q_n\text{-}(G_n)_o]\}_t$$

Formula XI

wherein:

n is an integer greater than 1;

each of f, g, h, i, j, k, l, o and t is independently an integer from 0 to 10;

each of E_1, E_2 and En is independently a linear polyamine;

each of G_1, G_2 and Gn is independently a cyclic polyamine; and

each of Q_1, Q_2 and Qn is independently a linker linking between two of said polyamines,

provided that at least one of said Q_1, Q_2 and Qn is an amine group and/or at least one of said linear polyamine and said cyclic polyamine is having at least one free amine group.

161. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 160, wherein each of said Q_1, Q_2 and Qn is independently selected from the group consisting alkylene, alkenylene, alkynylene, arylene, cycloalkylene, hetroarylene, amine, azo, amide, sulfonyl, sulfinyl, sulfonamide, phosphonyl, phosphinyl, phosphonium, ketoester, carbonyl, thiocarbonyl, ester, ether, thioether, carbamate, thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy and silaza.

162. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 159, wherein each of said E_1, E_2 and En is independently a linear polyamine having a general formula I:

$HX\text{-}Am\text{-}(Y_1B_1)_1\cdots(YnBn)n\text{-}ZH$

Formula I

wherein:

m is an integer from 1 to 10;

n is an integer from 0 to 20;

X and Z are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

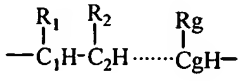
Y_1 and Yn are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

A is an alkylene chain having between 1 and 10 substituted and/or non-substituted carbon atoms; and

B_1 and Bn are each independently an alkylene chain having between 1 and 20 substituted and/or non-substituted carbon atoms,

provided that at least one of said X, Z, Y_1 and Yn is a -NH group and/or at least one of said carbon atoms in said alkylene chains is substituted by an amine group.

163. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 162, wherein said A is an alkylene chain having a general formula II:



Formula II

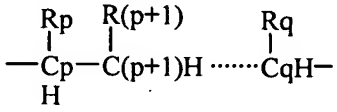
wherein:

g is an integer that equals 0 or 3-10;

each of R_1, R_2 and Rg is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate,

bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

164. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 163, wherein each of B_1 and Bn is independently an alkylene chain having a general formula III:



Formula III

wherein:

p is an integer that equals 0 or g+1;

q is an integer from g+2 to g+20; and

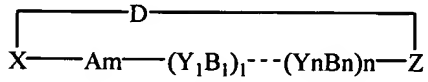
each of Rp, Rp+1 and Rq is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite,

bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

165. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 163, wherein at least one of said C_1, C_2 and Cg is a chiral carbon atom.

166. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 164, wherein at least one of said Cp, Cp+1 and Cq is a chiral carbon atom.

167. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 160, wherein each of said G_1, G_2 and Gn is independently a cyclic polyamine having a general formula IV:



Formula IV

wherein:

m is an integer from 1 to 10;

n is an integer from 0 to 20;

X and Z are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

Y_1 and Yn are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

A is an alkylene chain having between 1 and 10 substituted and/or non-substituted carbon atoms;

B_1 and Bn are each independently an alkylene chain having between 1 and 20 substituted and/or non-substituted carbon atoms; and

D is a bridging group having a general formula V:

U-W-V

Formula V

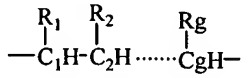
whereas:

U and V are each independently selected from the group consisting of substituted hydrocarbon chain and non-substituted hydrocarbon chain; and

W is selected from the group consisting of amide, ether, ester, disulfide, thioether, thioester, imine and alkene,

provided that at least one of said X, Z, Y_1 and Yn is a -NH group and/or at least one of said carbon atoms in said alkylene chains is substituted by an amine group.

168. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 167, wherein said A is an alkylene chain having a general formula II:



Formula II

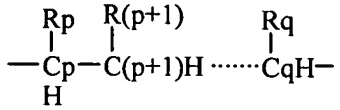
wherein:

g is an integer that equals 0 or 3-10; and

each of R_1, R_2 and Rg is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium,

thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

169. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 168, wherein each of B_1 and Bn is independently an alkylene chain having a general formula III:



Formula III

wherein:

p is an integer that equals 0 or g+1;

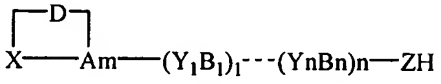
q is an integer from g+2 to g+20; and

each of Rp, Rp+1 and Rq is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

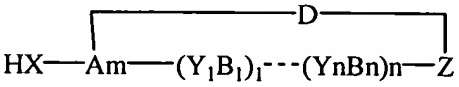
170. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 168, wherein at least one of said C_1, C_2 and Cg is a chiral carbon atom.

171. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 169, wherein at least one of said Cp, Cp+1 and Cq is a chiral carbon atom.

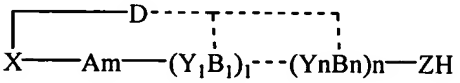
172. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 160, wherein said cyclic polyamine has a general formula selected from the group consisting of:



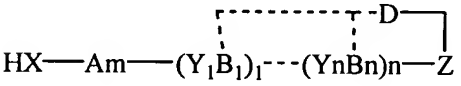
Formula VI



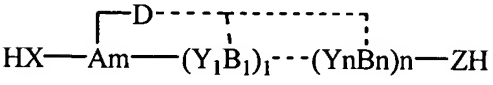
Formula VII



Formula VIII



Formula IX



Formula X

wherein:

m is an integer from 1 to 10;

n is an integer from 0 to 20;

X and Z are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

Y_1 and Yn are each independently selected from the group consisting of an oxygen atom, a sulfur atom and a -NH group;

A is an alkylene chain having between 1 and 10 substituted and/or non-substituted carbon atoms;

B1 and Bn are each independently an alkylene chain having between 1 and 20 substituted and/or non-substituted carbon atoms; and

D is a bridging group having a general formula V:

U-W-V

Formula V

whereas:

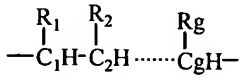
U and V are each independently selected from the group consisting of substituted hydrocarbon chain and non-substituted hydrocarbon chain; and

W is selected from the group consisting of amide, ether, ester, disulfide, thioether, thioester, imine and alkene,

and further wherein should said D is attached at one end to A (Formulas VI, VII and X), said U or said V are being attached to one carbon atom in said alkylene chain and should said D is attached at one end to B1 or Bn (Formulas VIII, IX and X), said U or said V are being attached to one carbon atom in said alkylene chain,

provided that at least one of said X, Z, Y_1 and Yn is a -NH group and/or at least one of said carbon atoms in said alkylene chains is substituted by an amine group.

173. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 172, wherein said A is an alkylene chain having a general formula II:



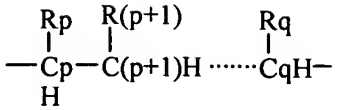
Formula II

wherein:

g is an integer that equals 0 or 3-10; and

each of R_1, R_2 and Rg is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide, phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, carboxylic acid, alkyl carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate, tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

174. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 173, wherein each of B_1 and Bn is independently an alkylene chain having a general formula III:



Formula III

wherein:

p is an integer that equals 0 or g+1;

q is an integer from g+2 to g+20; and

each of Rp, Rp+1 and Rq is independently selected from the group consisting of hydrogen, alkyl, alkenyl, alkynyl, aryl, cycloalkyl, heteroalicyclic, heteroaryl, halo, amino, alkylamino, arylamino, cycloalkylamino, heteroalicyclic amino, heteroarylamino, hydroxy, alkoxy, aryloxy, azo, C-amido, N-amido, ammonium, thiohydroxy, thioalkoxy, thioaryloxy, sulfonyl, sulfinyl, N-sulfonamide, S-sulfonamide phosphonyl, phosphinyl, phosphonium, carbonyl, thiocarbonyl, C-carboxy, O-carboxy, C-thiocarboxy, O-thiocarboxy, N-carbamate, O-carbamate, N-thiocarbamate, O-thiocarbamate, urea, thiourea, borate, borane, boroaza, silyl, siloxy, silaza, aquo, alcohol, peroxo, amine oxide, hydrazine, alkyl hydrazine, aryl hydrazine, nitric oxide, cyanate, thiocyanate, isocyanate, isothiocyanate, cyano, alkylnitrile, aryl nitrile, alkyl isonitrile, aryl isonitrile, nitrate, nitrite, azido, alkyl sulfonic acid, aryl sulfonic acid, alkyl sulfoxide, aryl sulfoxide, alkyl aryl sulfoxide, alkyl sulfenic acid, aryl sulfenic acid, alkyl sulfinic acid, aryl sulfinic acid, alkyl thiol carboxylic acid, aryl thiol carboxylic acid, alkyl thiol thiocarboxylic acid, aryl thiol thiocarboxylic acid, alkyl carboxylic acid, carboxylic acid, aryl carboxylic acid, sulfate, sulfite, bisulfite, thiosulfate, thiosulfite, alkyl phosphine, aryl phosphine, alkyl phosphine oxide, aryl phosphine oxide, alkyl aryl phosphine oxide, alkyl phosphine sulfide, aryl phosphine sulfide, alkyl aryl phosphine sulfide, alkyl phosphonic acid, aryl phosphonic acid, alkyl phosphinic acid, aryl phosphinic acid, phosphate, thiophosphate, phosphite, pyrophosphite, triphosphate, hydrogen phosphate, dihydrogen phosphate, guanidino, S-dithiocarbamate, N-dithiocarbamate, bicarbonate, carbonate, perchlorate, chlorate, chlorite, hypochlorite, perbromate, bromate, bromite, hypobromite, tetrahalomanganate, tetrafluoroborate, hexafluoroantimonate, hypophosphite, iodate, periodate, metaborate, tetraarylborate,

tetraalkyl borate, tartarate, salicylate, succinate, citrate, ascorbate, saccharirate, amino acid, hydroxamic acid and thiotosylate.

175. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 173, wherein at least one of said C_1, C_2 and Cg is a chiral carbon atom.

176. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 174, wherein at least one of said Cp, Cp+1 and Cq is a chiral carbon atom.

177. The method, the assay and/or the transplantable hematopoietic cell preparation of claim 137, wherein said polyamine chelator is selected from the group consisting of ethylendiamine, diethylenetriamine, triethylenetetramine, triethylenediamine, tetraethylenepentamine, aminoethylethanolamine, aminoethylpiperazine, pentaethylenehexamine, captopril, penicilamine, N,N'-bis(3-aminopropyl)-1,3-propanediamine, N,N'-Bis-(2-animoethyl)-1,3-propanediamine, 1,7-dioxa-4,10-diazacyclododecane, 1,4,8,11-tetraaza cyclotetradecane-5,7-dione, 1,4,7-triazacyclononane, 1-oxa-4,7,10-triazacyclododecane, 1,4,8,12-tetraazacyclopentadecane, and 1,4,7,10-tetraazacyclododecane.

178. An assay of determining whether a retinoic acid receptor antagonist is an effective hematopoietic stem cell expansion agent, the assay comprising culturing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of the retinoic acid receptor antagonist and monitoring expansion of said hematopoietic stem cells, wherein if increased expansion and decreased differentiation of said hematopoietic stem cells occurs, as compared to non-treated hematopoietic mononuclear cells, the retinoic acid receptor antagonist is an effective hematopoietic stem cell expansion agent.

179. The assay of claim 178, wherein said retinoic acid receptor antagonist is selected from the group consisting of: AGN 194310; AGN 193109; 3–(4-Methoxy-

phenylsulfanyl)-3-methyl-butyric acid; 6-Methoxy-2,2-dimethvl-thiochroman-4-one,2,2-Dimethyl-4-oxo-thiochroman-6-yltrifluoromethane-sulfonate; Ethyl 4-((2,2 dimethyl-4-oxo-thiochroman-6-yl)ethynyl)-benzoate; Ethyl 4-((2,2-dimethy 1-4-triflouromethanensulfonyloxy -(2H)- thiochromen-6-yl)ethynyl)-benzoate(41); Thiochromen-6-yl]-ethynyl]-benzoate(yl); (p-[(E)-2-[3'4'-Dihydro-4,4'-dimethyl-7'-(heptyloxy)-2'H-1-benzothiopyran-6'yl] propenyl] benzoic acid 1'1'-dioxide; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-butoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-propoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-pentoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-hexoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-heptoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-octoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; (2E,4E,6E)-7-[3-t-butyl-5-(1-phenyl-vinyl)-phenyl]-3-methyl-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-{[4,5-.sup.3 H.sub.2]-n-pentoxy}phenyl)-3-methyl]-octa-2,4,6-trienoic acid; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-ethoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid ethyl ester; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-ethoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-butoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-ethoxyphenyl]3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-butyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; 4-(5,6,7,8-tetrahydro-5,5,8,8-tetramethyl-2-naphthalene-carboxamido) benzoic acid; (2E,4E)-3-methyl-5-[(1S,2S)-2-(5,5,8,8-tetramethyl-5,6,7,8-tetrahydro-naphthalen-2-yl)-cyclopropyl]-penta-2,4-dienoic acid; p-[(E)-2-[3',4'-Dihydro-4',4'-dimethyl-7'-(heptyloxy)-2'H-1-benzothiopyran-6'-yl]propenyl]benzoic acid; 1',1'-dioxide, 4-(7,7,10,10-Tetramethyl-1-pyridin-3-ylmethyl-4,5,7,8,9,10-hexahydro-1H-naphto[2,3-g]indol-3-yl)-benzoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-methoxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-ethoxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-hexyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-octyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; and (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert-butyl-2-butoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid, (2E,4E,6Z)-7-(3-n-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)-3-methylocta-2,4,6-trienoic acid, 4-(5H-2,3(2,5

dimethyl-2,5-hexano)-5-n-propyldibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, 4-(5H-2,3-(2,5-dimethyl-2,5-hexano)-5methyl-8-nitrodibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, 4-{[4-(4-Ethylphenyl)2,2-dimethyl-(2H)-thiochromen-6-yl]ethynyl}benzoic acid, 4-[4-2methyl-1,2-dicarba-closo-dodecaboran-1-yl-phenylcarbamoyl]benzoic acid, 4-[4,5,7,8,9,10-hexahydro-7,7,10,10-tetramethyl-1-(3-pyridylmethyl)-anthra[1,2-b]pyrrol-3-yl]benzoic acid, (3-pyridylmethyl)-]5-thiaanthra[2,1-b]pyrrol-3-yl)benzoic acid, and (3-pyridylmethyl)-anthra[2m1-d]pyrazol-3-yl]benzoic acid.

180. An assay of determining whether a retinoid X receptor antagonist is an effective hematopoietic stem cell expansion agent, the assay comprising culturing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of the retinoid X receptor antagonist and monitoring expansion of said hematopoietic stem cells, wherein if increased expansion and decreased differentiation of said hematopoietic stem cells occurs, as compared to non-treated hematopoietic mononuclear cells, the retinoid X receptor antagonist is an effective hematopoietic stem cell expansion agent.

181. The assay of claim 180, wherein said retinoid X receptor antagonist is selected from the group consisting of: LGN100572, LGN100574, 1-(3-hydroxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)ethanone, 1-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)ethanone, 3-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)but-2-enenitrile, 3-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)but-2-enal, (2E,4E,6E)-7-3[-propoxy-5,6,7,8-tetrahydro 5,5,8,8-tetramethyl-2-naphthalene-2-yl]-3-methylocta-2,4,6-trienoic acid, 4-[3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl] benzoic acid, 4-[1-(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl] benzoic acid, 4-[1(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)cyclopropyl] benzoic acid, 4-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl] benzenete trazole, 2-[1-(5,5,8,8-tetramethyl-5,6,7,8-tetrahydro-2-naphthyl) ethenyl]pyridine-5-carboxylic acid, 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethyl]pyridine-5-carboxylic acid, ethyl-2-[1-(3,5,5,8, 8-

pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]pyridine-5-carboxylate, 5-[1-3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]pyridine-2-carboxylic acid, 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) cyclopropyl]pyridine-5-carboxylic acid, methyl 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)cyclopropyl]pyridine-5-carboxylate, 4-[1-(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]-N-(4-hydroxyphenyl) benzamide, 2-[1-(3,5,5,8,8-Pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) ethenyl] pyridine-5-carboxylic acid, 2-[1-(3,5,5,8,8-Pentamethyl-5, 6,7,8-tetrahydro-2-naphthyl)cyclopropyl]pyridine-5-carboxylic acid, 4-[(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid butyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) carbonyl]benzoic acid propyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-terrahydro-2-naphthyl)carbonyl]benzoic acid cyanoimine, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid allyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid 4-(3-methylbut-2-enoic acid)oxime, and 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid 1-aminoethyloxime, (2E,4E,6Z)-7-(3-n-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)-3-methylocta-2,4,6-trienoic acid, 4-(5H-2,3(2,5 dimethyl-2,5-hexano)-5-n-propyldibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, and 4-(5H-2,3-(2,5-dimethyl-2,5-hexano)-5methyl-8-nitrodibenzo[b,e][1,4]diazepin-11-yl)benzoic acid.

182. An assay of determining whether a vitamin D receptor antagonist is an effective hematopoietic stem cell expansion agent, the assay comprising culturing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of the vitamin D receptor antagonist and monitoring expansion of said hematopoietic stem cells, wherein if increased expansion and decreased differentiation of said hematopoietic stem cells occurs, as compared to non-treated hematopoietic mononuclear cells, the vitamin D receptor antagonist is an effective hematopoietic stem cell expansion agent.

183. The assay of claim 182, wherein said Vitamin D receptor antagonist is selected from the group consisting of: 1 alpha, 25-(OH)-D3-26,23 lactone; 1alpha, 25-

dihydroxyvitamin D (3); the 25-carboxylic ester ZK159222; (23S)- 25-dehydro-1 alpha-OH-D (3); (23R)-25-dehydro-1 alpha-OH-D (3); 1 beta, 25 $(OH)_2$ D_3; 1 beta, 25$(OH)_2$-3-epi-D_3; (23S) 25-dehydro-1 alpha(OH) D3-26,23-lactone; (23R) 25-dehydro-1 alpha(OH)D3-26,23-lactone and Butyl-(5Z,7E,22E-(1S,7E,22E-(1S,3R,24R)-1,3,24-trihydroxy-26,27-cyclo-9,10-secocholesta-5,7,10(19),22-tetraene-25-carboxylate).

184. An assay of determining whether an agent that inhibits PI 3-kinase activity is an effective hematopoietic stem cell expansion agent, the assay comprising culturing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of the agent that inhibits PI 3-kinase activity and monitoring expansion of said hematopoietic stem cells, wherein if increased expansion and decreased differentiation of said hematopoietic stem cells occurs, as compared to non-treated hematopoietic mononuclear cells, the agent that inhibits PI 3-kinase activity is an effective hematopoietic stem cell expansion agent.

185. An assay of determining whether a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide analog metabolite is an effective hematopoietic stem cell expansion agent, the assay comprising culturing hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells in the presence of a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide analog metabolite and monitoring expansion of said hematopoietic stem cells, wherein if increased expansion and decreased differentiation of said hematopoietic stem cells occurs, as compared to non-treated hematopoietic mononuclear cells, the a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide analog metabolite is an effective hematopoietic stem cell expansion agent.

186. The assay of any of claims 178, 180, 182, 184 and 185, wherein culturing said hematopoietic mononuclear cells is performed in a presence of an effective amount of a cytokine.

187. The assay of claim 186, wherein said cytokine is an early acting cytokines.

188. The assay of claim 187, wherein said early acting cytokine is selected from the group comprising stem cell factor, FLT3 ligand, interleukin-1, interleukin-2, interleukin-3, interleukin-6, interleukin-10, interleukin-12, tumor necrosis factor-α and thrombopoietin.

189. The assay of claim 186, wherein said cytokine is a late acting cytokines.

190. The assay of claim 189, wherein said late acting cytokines are selected from the group comprising granulocyte colony stimulating factor, granulocyte/macrophage colony stimulating factor, erythropoietin, FGF, EGF, NGF, VEGF, LIF, Hepatocyte growth factor and macrophage colony stimulating factor.

191. The assay of any of claims 178, 180, 182, 184 and 185, wherein said hematopoietic mononuclear cells are derived from a source selected from the group consisting of bone marrow, peripheral blood and neonatal umbilical cord blood.

192. The assay of any of claims 178, 180, 182, 184 and 185, wherein said monitoring decreased differentiation is by determining hematopoietic cell surface expression of CD34.

193. The assay of any of claims 178, 180, 182, 184 and 185, wherein said monitoring decreased differentiation is by determining an absence, or significantly diminished hematopoietic cell surface expression of CD38, CD3, CD61, CD19, CD33, CD14, CD15 or CD4.

194. A hematopoietic stem cells collection/culturing bag supplemented with an effective amount of a retinoic acid receptor antagonist, a retinoid X receptor antagonist and/or a Vitamin D receptor antagonist, which substantially inhibits cell differentiation of a hematopoietic stem cells fraction of hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells.

195. The hematopoietic stem cells collection/culturing bag of claim 194, wherein said retinoic acid receptor antagonist is selected from the group consisting of: AGN 194310; AGN 193109; 3–(4-Methoxy-phenylsulfanyl)-3-methyl-butyric acid; 6-Methoxy-2,2-dimethvl-thiochroman-4-one,2,2-Dimethyl-4-oxo-thiochroman-6-yltrifluoromethane-sulfonate; Ethyl 4-((2,2 dimethyl-4-oxo-thiochroman-6-yl)ethynyl)-benzoate; Ethyl 4-((2,2-dimethy 1-4-triflouromethanensulfonyloxy -(2H)-thiochromen-6-yl)ethynyl)-benzoate(41); Thiochromen-6-yl]-ethynyl]-benzoate(yl); (p-[(E)-2-[3'4'-Dihydro-4,4'-dimethyl-7'-(heptyloxy)-2'H-1-benzothiopyran-6'yl] propenyl] benzoic acid 1'1'-dioxide; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-butoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-propoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-pentoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-hexoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-heptoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-n-octoxyphenyl)-3-methyl]-octa-2,4,6-trienoic acid; (2E,4E,6E)-7-[3-t-butyl-5-(1-phenyl-vinyl)-phenyl]-3-methyl-octa-2,4,6-trienoic acid; 2E,4E,6E-[7-(3,5-Di-t-butyl-4-{[4,5-.sup.3 H.sub.2]-n-pentoxy}phenyl)-3-methyl]-octa-2,4,6-trienoic acid; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-ethoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid ethyl ester; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-ethoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid; (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert.butyl-2-butoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-ethoxyphenyl]3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-butyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; 4-(5,6,7,8-tetrahydro-5,5,8,8-tetramethyl-2-naphthalene-carboxamido) benzoic acid; (2E,4E)-3-methyl-5-[(1S,2S)-2-(5,5,8,8-tetramethyl-5,6,7,8-tetrahydro-naphthalen-2-yl)-cyclopropyl]-penta-2,4-dienoic acid; p-[(E)-2-[3',4'-Dihydro-4',4'-dimethyl-7'-

(heptyloxy)-2'H-1-benzothiopyran-6'-yl]propenyl]benzoic acid; 1',1'-dioxide, 4-(7,7,10,10-Tetramethyl-1-pyridin-3-ylmethyl-4,5,7,8,9,10-hexahydro-1H-naphto[2,3-g]indol-3-yl)-benzoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-methoxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-ethoxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-hexyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; (2E,4E,6Z)-7-[3,5-di-tert.butyl-2-octyloxyphenyl]-3-methyl-2,4,6-octatrienoic acid; and (2E,4E)-(1RS,2RS)-5-[2-(3,5-di-tert-butyl-2-butoxy-phenyl)-cyclopropyl]-3-methyl-penta-2,4-dienoic acid. (2E,4E,6Z)-7-(3-n-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)-3-methylocta-2,4,6-trienoic acid, 4-(5H-2,3(2,5. dimethyl-2,5-hexano)-5-n-propyldibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, 4-(5H-2,3-(2,5-dimethyl-2,5-hexano)-5methyl-8-nitrodibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, 4-{[4-(4-Ethylphenyl)2,2-dimethyl-(2H)-thiochromen-6-yl]ethynyl}benzoic acid, 4-[4-2methyl-1,2-dicarba-closo-dodecaboran-1-yl-phenylcarbamoyl]benzoic acid, 4-[4,5,7,8,9,10-hexahydro-7,7,10,10-tetramethyl-1-(3-pyridylmethyl)-anthra[1,2-b]pyrrol-3-yl]benzoic acid, (3-pyridylmethyl)-]5-thiaanthra[2,1-b]pyrrol-3-yl)benzoic acid, and (3-pyridylmethyl)-anthra[2m1-d]pyrazol-3-yl]benzoic acid.

196. The hematopoietic stem cell collection bag of claim 194, wherein said retinoid X receptor antagonist is selected from the group consisting of: LGN100572, LGN100574, 1-(3-hydroxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)ethanone, 1-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)ethanone, 3-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)but-2-enenitrile, 3-(3-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)but-2-enal, (2E,4E,6E)-7-3[-propoxy-5,6,7,8-tetrahydro 5,5,8,8-tetramethyl-2-naphthalene-2-yl]-3-methylocta-2,4,6-trienoic acid, 4-[3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl] benzoic acid, 4-[1-(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl] benzoic acid, 4-[1(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)cyclopropyl] benzoic acid, 4-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl] benzenete trazole, 2-[1-(5,5,8,8-tetramethyl-5,6,7,8-tetrahydro-2-naphthyl) ethenyl]pyridine-5-carboxylic acid, 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethyl]pyridine-5-carboxylic acid, ethyl-2-[1-(3,5,5,8, 8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]pyridine-5-

carboxylate, 5-[1-3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]pyridine-2-carboxylic acid, 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) cyclopropyl]pyridine-5-carboxylic acid, methyl 2-[1-(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)cyclopropyl]pyridine-5-carboxylate, 4-[1-(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)ethenyl]-N-(4-hydroxyphenyl) benzamide, 2-[1-(3,5,5,8,8-Pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) ethenyl] pyridine-5-carboxylic acid, 2-[1-(3,5,5,8,8-Pentamethyl-5, 6,7,8-tetrahydro-2-naphthyl)cyclopropyl]pyridine-5-carboxylic acid, 4-[(3,5, 5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid butyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl) carbonyl]benzoic acid propyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-terrahydro-2-naphthyl)carbonyl]benzoic acid cyanoimine, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid allyloxime, 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid 4-(3-methylbut-2-enoic acid)oxime, and 4-[(3,5,5,8,8-pentamethyl-5,6,7,8-tetrahydro-2-naphthyl)carbonyl]benzoic acid 1-aminoethyloxime, (2E,4E,6Z)-7-(3-n-propoxy-5,6,7,8-tetrahydro-5,5,8,8-tetramethylnaphthalene-2-yl)-3-methylocta-2,4,6-trienoic acid, 4-(5H-2,3(2,5 dimethyl-2,5-hexano)-5-n-propyldibenzo[b,e][1,4]diazepin-11-yl)benzoic acid, and 4-(5H-2,3-(2,5-dimethyl-2,5-hexano)-5methyl-8-nitrodibenzo[b,e][1,4]diazepin-11-yl)benzoic acid.

197. The hematopoietic stem cell collection bag of claim 194, wherein said Vitamin D receptor antagonist is selected from the group consisting of: 1 alpha, 25-(OH)-D3-26,23 lactone; 1alpha, 25-dihydroxyvitamin D (3); the 25-carboxylic ester ZK159222; (23S)- 25-dehydro-1 alpha-OH-D (3); (23R)-25-dehydro-1 alpha-OH-D (3); 1 beta, 25 $(OH)_2$ D_3; 1 beta, 25$(OH)_2$-3-epi-D_3; (23S) 25-dehydro-1 alpha(OH) D3-26,23-lactone; (23R) 25-dehydro-1 alpha(OH)D3-26,23-lactone and Butyl-(5Z,7E,22E-(1S,7E,22E-(1S,3R,24R)-1,3,24-trihydroxy-26,27-cyclo-9,10-secocholesta-5,7,10(19),22-tetraene-25-carboxylate).

198. A hematopoietic stem cells collection/culturing bag supplemented with an effective amount of nicotinamide, a nicotinamide analog, a nicotinamide or a nicotinamide analog derivative or a nicotinamide or a nicotinamide analog metabolite,

which substantially inhibits cell differentiation of a hematopoietic stem cells fraction of hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells.

199. A hematopoietic stem cells collection/culturing bag supplemented with an effective amount of an agent that inhibits PI 3-kinase activity, which substantially inhibits cell differentiation of a hematopoietic stem cells fraction of hematopoietic mononuclear cells which comprise a major fraction of hematopoietic committed cells and a minor fraction of hematopoietic stem and progenitor cells.

200. An *ex-vivo* expanded population of hematopoietic stem cells, obtained by the method of any of claims 1, 38, 59, 80, 95 and 118.